NGP8203N

Advance Information

Ignition IGBT

20 A, 400 V, N−Channel TO−220

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over−Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

Features

- Ideal for Coil−on−Plug and Driver−on−Coil Applications
- Gate−Emitter ESD Protection
- Temperature Compensated Gate−Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage for Interfacing Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Optional Gate Resistor (R_G) and Gate−Emitter Resistor (R_{GE})

Applications

- Ignition Systems

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CES}	440	V
Collector−Gate Voltage	V_{CER}	440	V
Gate−Emitter Voltage	V_{GE}	±15	V
Collector Current−Continuous @ T_C = 25°C − Pulsed	I_C	20 50	A_{DC} A_{AC}
Continuous Gate Current	I_G	1.0	mA
Transient Gate Current (t≤2 ms, f≤100 Hz)	I_G	20	mA
ESD (Charged−Device Model)	ESD	2.0	kV
ESD (Human Body Model) R = 1500 Ω, C = 100 pF	ESD	8.0	kV
ESD (Machine Model) R = 0 Ω, C = 200 pF	ESD	500	V
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	150 1.0	Watts W/°C
Operating & Storage Temperature Range	T_J, T_{stg}	−55 to +175	°C

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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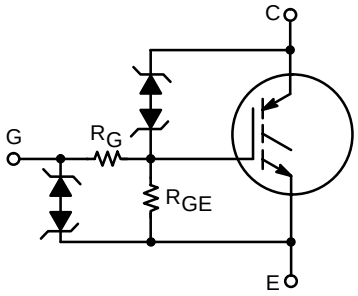
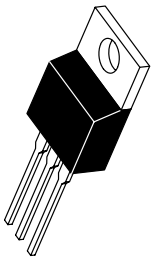
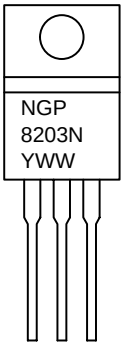
20 AMPS
400 VOLTS
$V_{CE(on)}$ = 1.3 V @
I_C = 10 A, V_{GE} ≥ 4.5 V





TO−220
CASE 221A
STYLE 9

MARKING DIAGRAM



NGP8203N = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
NGP8203N	TO−220	50 Units / Rail

UNCLAMPED COLLECTOR−TO−EMITTER AVALANCHE CHARACTERISTICS (−55° ≤ T_J ≤ 175°C)

Characteristic	Symbol	Value	Unit
Single Pulse Collector−to−Emitter Avalanche Energy V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_L = 16.7 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 25°C V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_L = 14.9 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 150°C V_{CC} = 50 V, V_{GE} = 5.0 V, Pk I_L = 14.1 A, R_G = 1000 Ω, L = 1.8 mH, Starting T_J = 175°C	E_{AS}	 250 200 180	mJ
Reverse Avalanche Energy V_{CC} = 100 V, V_{GE} = 20 V, Pk I_L = 25.8 A, L = 6.0 mH, Starting T_J = 25°C	$E_{AS(R)}$	2000	mJ

THERMAL CHARACTERISTICS

Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	°C/W
Maximum Temperature for Soldering Purposes, 1/8″ from case for 5 seconds (Note 1)	T_L	275	°C

1. For further details, see Soldering and Mounting Techniques Reference Manual: SOLDERRM/D.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Collector−Emitter Clamp Voltage	BV_{CES}	I_C = 2.0 mA	T_J = −40°C to 175°C	370	395	420	V
		I_C = 10 mA	T_J = −40°C to 175°C	390	415	440	
Zero Gate Voltage Collector Current	I_{CES}	V_{GE} = 0 V, V_{CE} = 15 V	T_J = 25°C		0.1	1.0	μA
		V_{CE} = 200 V, V_{GE} = 0 V	T_J = 25°C	0.5	1.5	10	μA
			T_J = 175°C	1.0	25	100*	
			T_J = −40°C	0.4	0.8	5.0	
Reverse Collector−Emitter Clamp Voltage	$B_{VCES(R)}$	I_C = −75 mA	T_J = 25°C	30	35	39	V
			T_J = 175°C	35	39	45*	
			T_J = −40°C	30	33	37	
Reverse Collector−Emitter Leakage Current	$I_{CES(R)}$	V_{CE} = −24 V	T_J = 25°C	0.05	0.1	0.5	mA
			T_J = 175°C	1.0	5.0	10*	
			T_J = −40°C	0.005	0.01	0.1	
Gate−Emitter Clamp Voltage	BV_{GES}	I_G = ±5.0 mA	T_J = −40°C to 175°C	12	12.5	14	V
Gate−Emitter Leakage Current	I_{GES}	V_{GE} = ±5.0 V	T_J = −40°C to 175°C	200	300	350*	μA
Gate Resistor (Optional)	R_G		T_J = −40°C to 175°C		70		Ω
Gate Emitter Resistor	R_{GE}		T_J = −40°C to 175°C	14.25	16	25	kΩ
ON CHARACTERISTICS (Note 2)							
Gate Threshold Voltage	$V_{GE(th)}$	I_C = 1.0 mA, V_{GE} = V_{CE}	T_J = 25°C	1.5	1.8	2.1	V
			T_J = 175°C	0.7	1.0	1.3	
			T_J = −40°C	1.7	2.0	2.3*	
Threshold Temperature Coefficient (Negative)				4.0	4.6	5.2	mV/°C

2. Pulse Test: Pulse Width ≤ 300 μS, Duty Cycle ≤ 2%.
*Maximum Value of Characteristic across Temperature Range.

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Test Conditions	Temperature	Min	Typ	Max	Unit
ON CHARACTERISTICS (Note 3)							
Collector−to−Emitter On−Voltage	$V_{CE(on)}$	I_C = 6.5 A, V_{GE} = 3.7 V	T_J = 25°C	0.95	1.15	1.35	V
			T_J = 175°C	0.7	0.95	1.15	
			T_J = −40°C	1.0	1.3	1.40	
		I_C = 9.0 A, V_{GE} = 3.9 V	T_J = 25°C	0.95	1.25	1.45	
			T_J = 175°C	0.8	1.05	1.25	
			T_J = −40°C	1.1	1.4	1.5	
		I_C = 7.5 A, V_{GE} = 4.5 V	T_J = 25°C	0.85	1.15	1.4	
			T_J = 175°C	0.7	0.95	1.2	
			T_J = −40°C	1.0	1.3	1.6*	
		I_C = 10 A, V_{GE} = 4.5 V	T_J = 25°C	1.0	1.3	1.6	
			T_J = 175°C	0.8	1.05	1.4	
			T_J = −40°C	1.1	1.4	1.7*	
		I_C = 15 A, V_{GE} = 4.5 V	T_J = 25°C	1.15	1.45	1.7	
			T_J = 175°C	1.0	1.3	1.55	
			T_J = −40°C	1.25	1.55	1.8*	
		I_C = 20 A, V_{GE} = 4.5 V	T_J = 25°C	1.3	1.6	1.9	
			T_J = 175°C	1.2	1.5	1.8	
			T_J = −40°C	1.4	1.75	2.0*	
Forward Transconductance	gfs	I_C = 6.0 A, V_{CE} = 5.0 V	T_J = 25°C	10	18	25	Mhos
DYNAMIC CHARACTERISTICS							
Input Capacitance	C_{ISS}	f = 10 kHz, V_{CE} = 25 V	T_J = 25°C	1100	1300	1500	pF
Output Capacitance	C_{OSS}			70	80	90	
Transfer Capacitance	C_{RSS}			18	20	22	
SWITCHING CHARACTERISTICS							
Turn−Off Delay Time (Resistive)	$t_{d(off)}$	V_{CC} = 300 V, I_C = 9.0 A, R_G = 1.0 kΩ, R_L = 33 Ω, V_{GE} = 5.0 V	T_J = 25°C	6.0	8.0	10	μSec
			T_J = 175°C	6.0	8.0	10	
Fall Time (Resistive)	t_f		T_J = 25°C	4.0	6.0	8.0	
			T_J = 175°C	8.0	10.5	14	
Turn−Off Delay Time (Inductive)	$t_{d(off)}$	V_{CC} = 300 V, I_C = 9.0 A, R_G = 1.0 kΩ, L = 300 μH, V_{GE} = 5.0 V	T_J = 25°C	3.0	5.0	7.0	
			T_J = 175°C	5.0	7.0	9.0	
Fall Time (Inductive)	t_f		T_J = 25°C	1.5	3.0	4.5	
			T_J = 175°C	5.0	7.0	10	
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 14 V, I_C = 9.0 A, R_G = 1.0 kΩ, R_L = 1.5 Ω, V_{GE} = 5.0 V	T_J = 25°C	1.0	1.5	2.0	
			T_J = 175°C	1.0	1.5	2.0	
Rise Time	t_r		T_J = 25°C	4.0	6.0	8.0	
			T_J = 175°C	3.0	5.0	7.0	

3. Pulse Test: Pulse Width ≤ 300 μS, Duty Cycle ≤ 2%.
*Maximum Value of Characteristic across Temperature Range.

TYPICAL ELECTRICAL CHARACTERISTICS

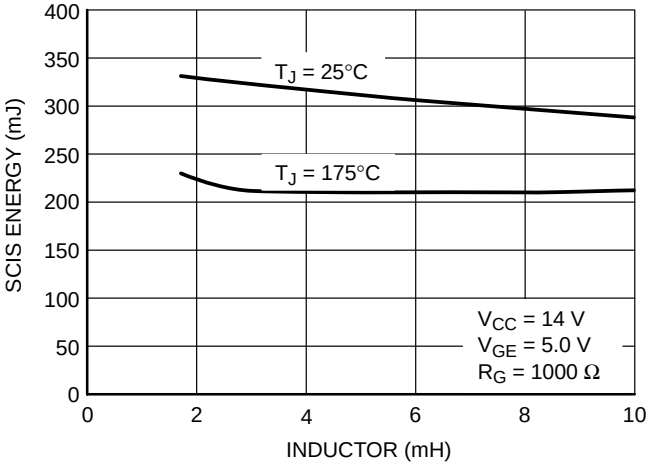


Figure 1. Self Clamped Inductive Switching

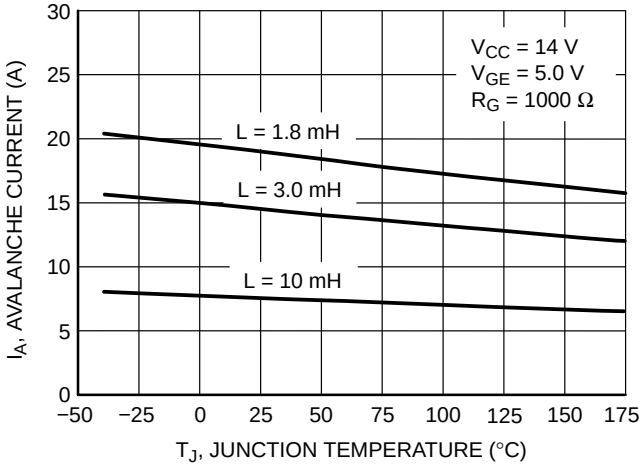


Figure 2. Open Secondary Avalanche Current vs. Temperature

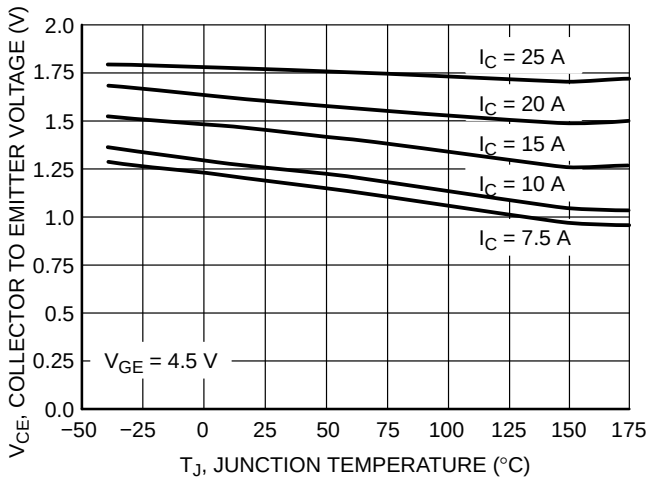


Figure 3. Collector−to−Emitter Voltage vs. Junction Temperature

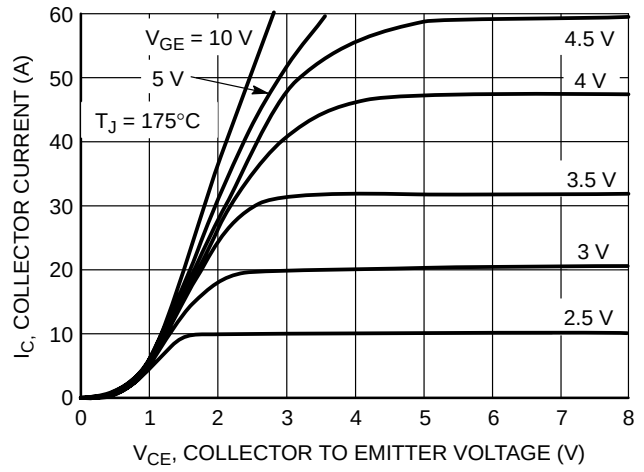


Figure 4. Collector Current vs. Collector−to−Emitter Voltage

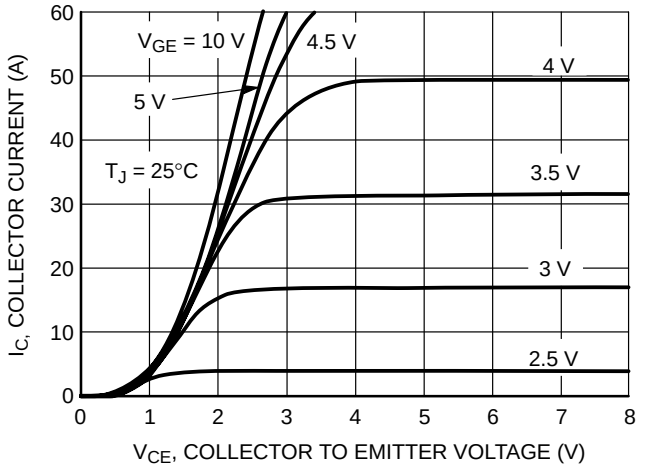


Figure 5. Collector Current vs. Collector−to−Emitter Voltage

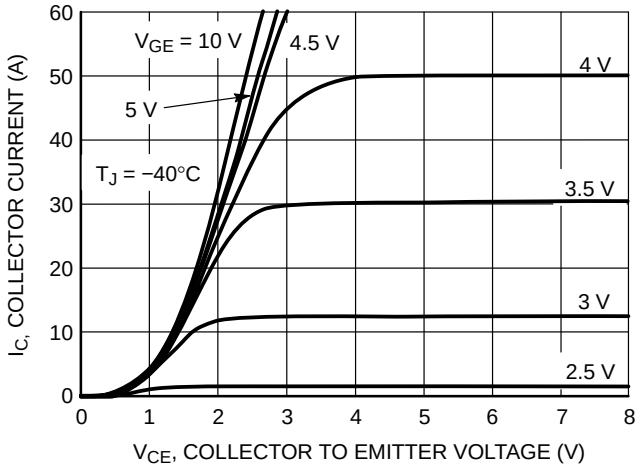


Figure 6. Collector Current vs. Collector−to−Emitter Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

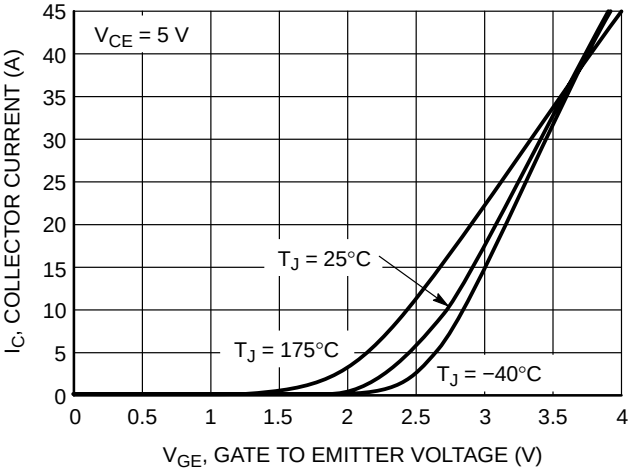


Figure 7. Transfer Characteristics

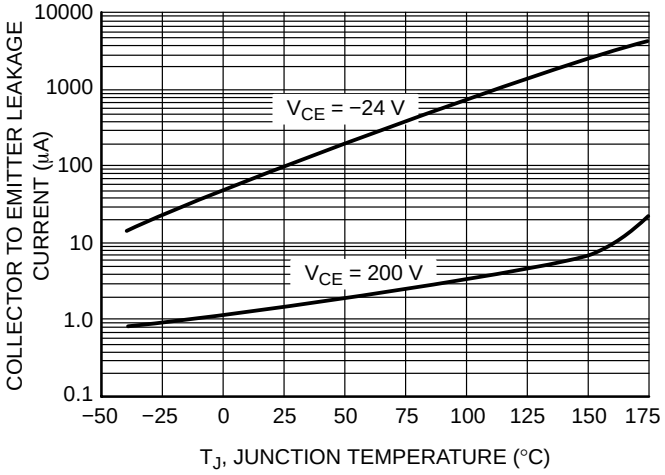


Figure 8. Collector−to−Emitter Leakage Current vs. Temperature

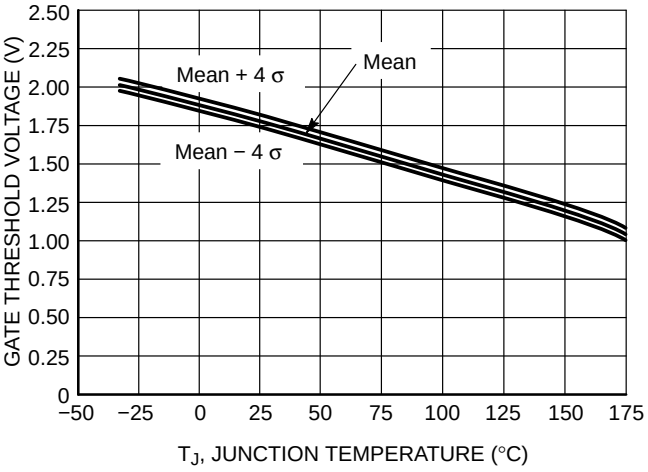


Figure 9. Gate Threshold Voltage vs. Temperature

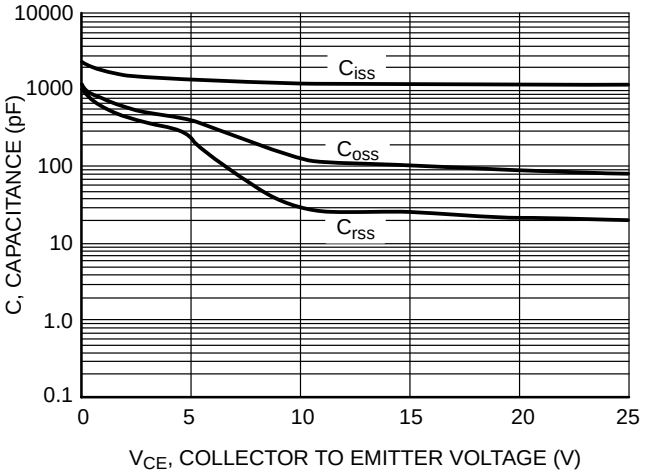


Figure 10. Capacitance vs. Collector−to−Emitter Voltage

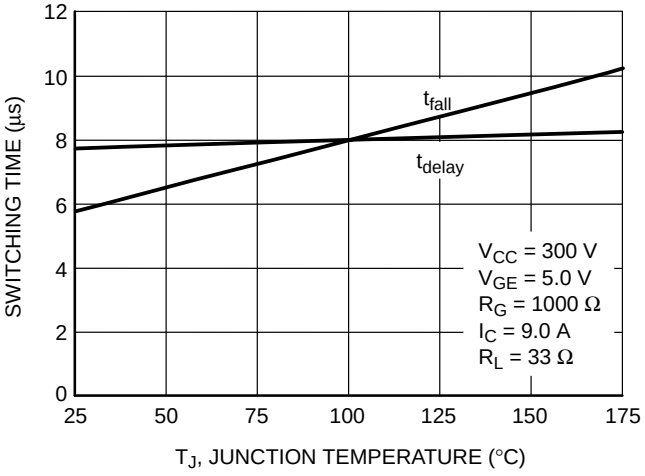


Figure 11. Resistive Switching Fall Time vs. Temperature

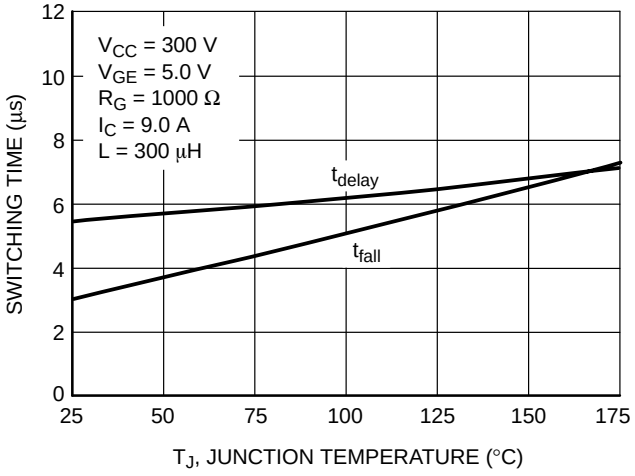


Figure 12. Inductive Switching Fall Time vs. Temperature

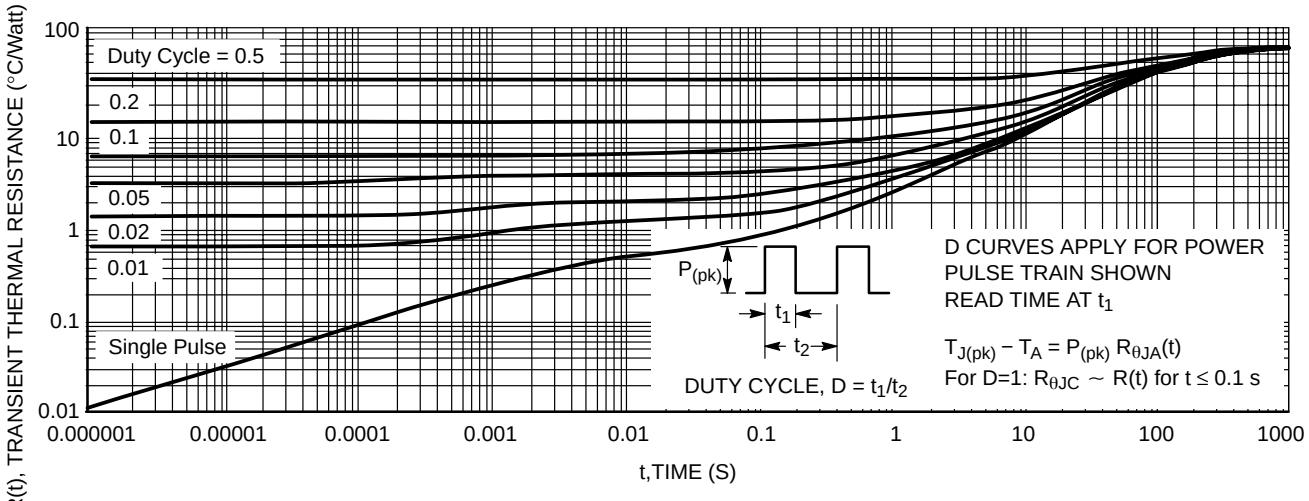


Figure 13. Transient Thermal Resistance
(Non−normalized Junction−to−Ambient)

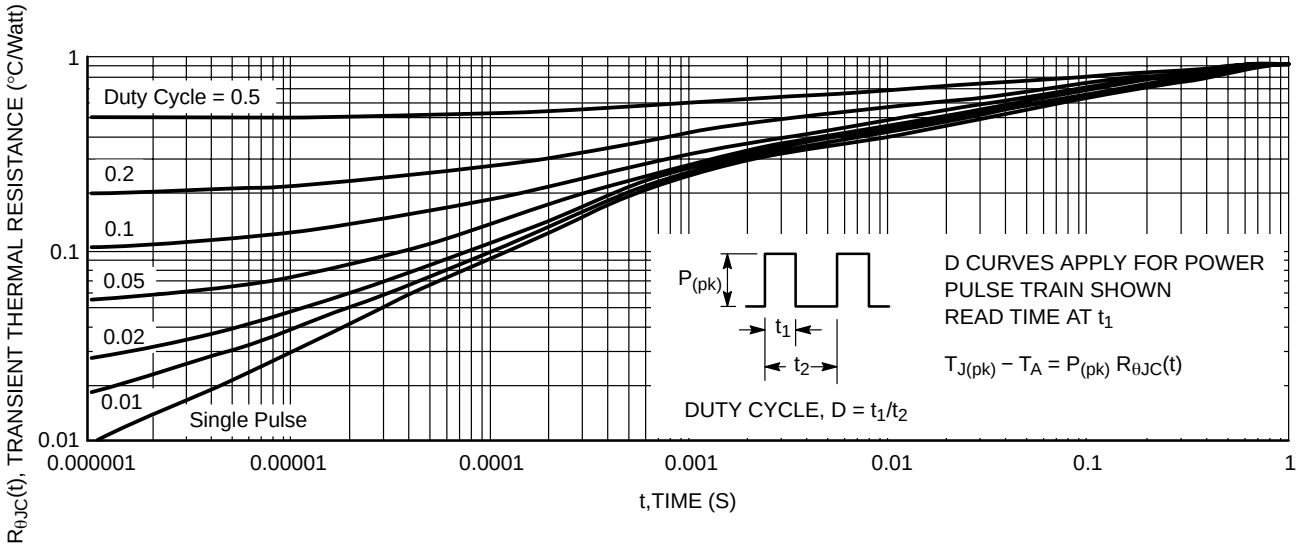
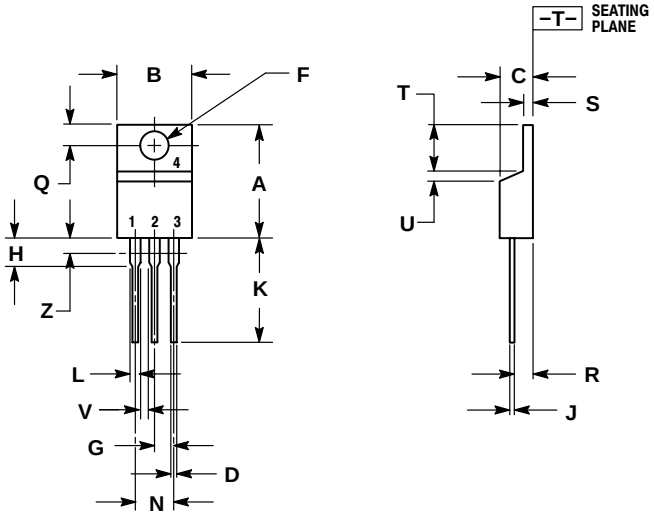


Figure 14. Best Case Transient Thermal Resistance
(Non−normalized Junction−to−Case Mounted on Cold Plate)

PACKAGE DIMENSIONS

TO−220
CASE 221A−07
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.014	0.022	0.36	0.55
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

PUBLICATION ORDERING INFORMATION

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